(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 356 793 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **24.02.93**

(51) Int. Cl.5: **F16D 55/24**, F16D 13/38

(21) Application number: **89114912.2**

(22) Date of filing: **11.08.89**

(54) **Disc brake or clutch.**

(30) Priority: **29.08.88 US 237792**

(43) Date of publication of application:
07.03.90 Bulletin 90/10

(45) Publication of the grant of the patent:
24.02.93 Bulletin 93/08

(84) Designated Contracting States:
DE ES FR GB IT

(56) References cited:
EP-A- 0 138 345
FR-A- 2 208 482

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Description

This invention relates to air cooled or water cooled disc brakes in which the brake is applied by a spring and released by air pressure or vise versa e.g. the brake is applied by air and released by springs. It will appreciated by those skilled in the art that the invention in its broader sense may be applicable to any such disc type brake or clutch or torque transmitting device whether air cooled or liquid cooled.

Torque transmitting devices of the disc type are known in the art and generally comprise an external housing which carries and positions annular axially moveable and fixed reaction members having a disc therebetween. U.S. Patent No. 3,398,822 to Eakin discloses an air cooled spring applied brake or clutch which is air released by pressurization of a pressure chamber to axially move an end plate and pressure plate to overcome the force of the springs. The brake disc in the Eakin patent is provided with a spline coacting with an externally splined hub 10. Naturally the spline connection between the brake disc and the hub permits the brake disc to slide axially along the hub but necessarily restricts the diameter of the drive shaft.

On the other hand, prior art U.S. Patent No. 3,862,678 to Collins discloses a liquid cooled torque transmitting device of the disc type provided with radially outer tube type spacers and bolts for connecting two fixed reaction end plates in fixed relationship and between which are mounted a pair of driven discs splined to the drive shaft.

It is an object of this invention to provide an improved torque transmitting device in which the friction disc assembly floats axially on bushings which are bolted to the hub which in turn is fixed to the shaft so that the shaft diameter nearly equal to the inner diameter to the friction rotor disc can be accommodated. Moveover, this arrangement eliminates the cost of cutting splined and/or gear teeth both in the hub and the rotor of the prior art friction disc assembly.

Another object of the invention is to provide a substantial commonality of components between spring applied and air applied devices in which a first plurality of connecting means secure a pair of fixed reaction members together and which extend through openings in one of a pair of moveable reaction members which are clamped between a second plurality of connecting means. Another object of the invention is to provide a torque transmitting device in which connecting means for the axially moveable members and the axially fixed members are positioned radially outwardly of the rotor disc and the reaction members.

In the accompanying drawings:

Fig. 1 is an axial sectional view through the spring applied air released brake or clutch of this invention taken along the line 1-1 of Fig. 2.

Fig. 2 is a end view of the brake shown in Fig. 1.

Fig. 3 is a plan view of the spring housing.

Fig. 4 is a cross-sectional view taken along the lines 4-4 of Fig. 3.

Fig. 5 is a plan view of the pressure disc.

Fig. 6 is a cross-sectional view taken along the lines 6-6 of Fig. 5.

Fig. 7 is a view similar to Fig. 1 of another embodiment of the invention.

Referring to Figs. 1 through 6 of the drawings, the spring applied brake 10 includes a rotatable brake assembly which includes a rotatable input shaft 11 and an annular radially disposed brake disc 12 which is secured to the shaft 11 for rotation in unison therewith but mounted for limited axial movement along the shaft 11. Preferably, the brake disc 12 is provided with a plurality of circumferentially faced holes 13 along its inner periphery. A stud or bolt 14 extends through each hole 13 and is threaded secured to an annular ring member 15 which is keyed, welded, or otherwise secured to the shaft 11. Each of the studs or bolts 14 may be provided with a head 16 to limit the axial movement of the brake disc 12 along the stud 14.

An annular friction disc 18, made of a well-known friction matter, is secured to each side of the brake disc 12. The brake assembly 10 also has a non-rotating structure which includes a rigid, fixed assembly 19 and a rigid axially moveable assembly 20.

The axially fixed assembly 19 includes a fixed spring housing 23 shown in Figs. 3 and 4 and a fixed reaction disc member 21 rigidly mounted to a stationary support S by fasteners 22. The disc 21 and spring housing 23 are secured together by the studs or bolts 24 passing through the spacer tubes 25 and also through a hole 26 in the spring housing 23. The holes 26, the spacer tubes 25, and studs 24 are circumferentially spaced apart at the radially outer periphery of the housing 23. The ends of the spacer tubes 25 bear against the axially facing surfaces of the disc 21 and the spring housing 23 and the studs 24 secure the tubes 25 to the disc 21 and spring housing 23 to form an assembly 19.

The axially movable assembly 20 includes a pressure plate 27, shown in Figs. 5 and 6, which is secured to the cylinder member 28 by the studs or bolts 29 passing through holes 34 in the plate 27 and in the spacer tubes 30 which are circumferentially spaced apart at the radially outer periphery thereof. The studs 29 pass through holes in the cylinder member 28 and are secured by the nuts 31. The studs 29 and tubes 30 also pass through holes 32 in the spring housing 23 and the tubes 25

pass through holes 33 in the pressure plate 27 so that the unitary assembly 20 is moveable axially as a unit. The movable assembly 20 is thus axially slideable a limited distance relative to the axial fixed assembly 19 with the studs 29 and tubes 30 of the assembly 20 slideable through the holes 32 in the spring housing 23. Also, the movable assembly 20 is supported for axial movement by the annular radially inner facing surface of the spring housing 23 slideably supported on the annular radially outer facing surfaces 42 of the cylinder member 28.

The axially moveable assembly 20 is normally biased to the left of Fig. 1, by a plurality of springs 35 so that the pressure plate 27 bears against the friction disc 18. One end of each of the springs 35 is positioned within a depression 36 in the pressure plate 27. The other end of each of the springs 35 surrounds a projection 37 in the spring housing. Each of the projections 37, the depressions 36 and the springs 35 are of course axially aligned and are located radially inwardly of the respective studs 24 and tubes 25 as well as the studs 29 and spacer tubes 30.

The brake is released by injecting a pressurized fluid into the pressure chamber 38 defined by the annular face 40 of the spring housing 23 having suitable radially inner and outer seals 41 in sealing engagement with the radially facing surfaces 42 and the annular axially facing end surface 43 formed in the cylinder member 28. When pressurized fluid is injected through the orifices 39 into the chamber 38, the axial moveable assembly 20 is moved to the right of Fig. 1 so that the pressure plate 27 thereof is moved a slight distance away from the friction disc 18, thus compressing the springs 35 and releasing the brake. When the pressure plate 27 is moved slightly to the right of Fig. 1, the brake disc 12 will move a slight distance along the bolt 14 so that braking forces are relieved between the fixed reaction disc 21 and the friction disc 18.

In the embodiment of the invention shown in Fig. 7, the axially fixed assembly 19 includes a fixed spring housing 23, a fixed reaction disc member 21 which are secured together by the studs 24 passing through spacer tubes 25 and also through holes in the housing 23 and disc member 21. The spacer tubes 25 and studs 24 are circumferentially spaced apart at the radially outer periphery of the spring housing 23, in a similar manner to that shown in Fig. 1.

The axially moveable assembly 20 of the modification shown in Fig. 7 includes a pressure plate 27 which is secured to the cylinder member 28 by studs 29 passing through holes in the pressure plate and in the spacer members 30 which are circumferentially spaced apart at the radially inner periphery thereof. The spring housing 23 includes a plurality of radially spaced cup-shaped members 44 at the radially outer most periphery thereof for housing the springs 35. The cup-shaped members 44 are positioned radially outwardly of the studs 29 and spacer members 30. The pressure chamber 38 is located radially between the inner studs 29 and spacer members 30 and the outer studs 24 and spacer tubes 25 with the chamber 38 located axially intermediate the ends of the inner studs 29.

The brake shown in Fig. 7 is released by injecting pressurized fluid into the pressure chamber 38 through the orifices 39 to move the axial moveable assembly 20, thereby compressing the springs 35 and releasing the brake.

Claims

1. A spring applied coupling device (10) comprising:

a relatively rotatable input shaft (11):

a radially outwardly extending rotor disc (12) including inner and outer peripheral surfaces and means (14) (15) for mounting said disc for rotation with said input shaft (12);

a first annular axially fixed reaction member (21) adjacent one side of said rotor disc (12);

a second annular axially fixed reaction member (23) positioned on the opposite side of said rotor disc (12);

a plurality of first connecting means (24) (25) for connecting said first and second axially fixed reaction members in fixed axially-spaced relationship, all of said plurality of connecting means extending axially and positioned radially outwardly from said outer peripheral surface of said rotor disc (12);

a first annular axially movable reaction member (27) positioned between said opposite side of said rotor disc (12) and said second axially fixed reaction member (23);

a second relatively movable annular reaction member (28);

a plurality of second connecting means (29,30) for connecting said first and second movable reaction members to each other a fixed axial distance apart, all of said plurality of connecting means extending axially and positioned radially outwardly from said outer peripheral surface of said rotor disc;

an annular disc of friction material (18) secured between each radially extending side of said rotor disc and said first fixed and said first movable reaction members;

spring means (35) between said first axially movable reaction member (27) and said second relatively fixed reaction member (23)

for biasing said movable reaction member into frictional engagement with said disc;

said second fixed reaction member (23) and the second movable reaction member (28) forming an annular pressure chamber (38) which when pressurized causes said movable members to move axially away from said rotor disc to compress said spring means and disengage said first annular annular axially movable reaction member from said disc.

2. A spring applied coupling device as claimed in Claim 1 in which said first moveable reaction member (27) is slidably mounted on said first connecting means (24, 25).

3. A spring applied coupling device as claimed in Claim 2 in which said first connecting means (24, 25) includes a spacer tube (25) positioned between said first and second relatively fixed reaction members and fastener means (24) for securing said first and second reaction members together.

4. A spring applied coupling device as claimed in Claim 3 in which said fastening means (24) passes through said tubular spacer means (25).

5. A spring applied coupling devices as claimed in Claim 1 in which said second connecting means (29, 30) includes a spacer tube (30) positioned between said first and second moveable reaction members and fastener means (29) for securing said first and second reaction members together.

6. A spring applied coupling device as claimed in Claim 5 in which said fastening means (29) passes through said tubular spacer means (30).

7. A spring applied coupling device as claimed in claim 1 in which each of said plurality of said first (24, 25) and second (29, 30) connecting means are offset circumferentially and are accessible from one side of said device.

8. A spring applied coupling device as claimed in Claim 1 in which said pressurized chamber (38) is positioned radially inside of said first and second connecting means.

9. A spring applied coupling (10) as defined in claim 1 wherein said second fixed reaction member (23) comprises an annular piston, said second movable reaction member (28) comprises an annular chamber for receiving said annular piston therein and for defining said annular pressure chamber (38) between said annular piston and said annular chamber, said annular pressure chamber (38) when pressurized effecting movement of said second movable reaction member (28) relative to said annular piston (23) to compress said spring means (35) and disengage said first annular reaction member (27) from said disc (12).

10. A spring applied coupling device (10) as claimed in Claim 1;
wherein said second connecting means (29,30) includes a spacer tube (30) positioned between said first and second movable reaction members and fastener means (29) passing through said tubular spacer means (30) for securing said first and second reaction members together; and
wherein said second fixed reaction member (23) comprises an annular piston, said second movable reaction member (28) comprises an annular chamber for receiving said annular piston therein and for defining said annular pressure chamber (38) between said annular piston and said annular chamber, said annular pressure chamber (38) when pressurized effecting movement of said second movable reaction member (28) relative to said annular piston (23) to compress said spring means (35) and disengage said first annular reaction member (27) from said disc (12).

Patentansprüche

1. Federbetätigte bzw. -angelegte Kupplungsvorrichtung (10), die folgendes aufweist:
eine relativ drehbare Eingangswelle (11);
eine sich radial nach außen erstreckende Rotorscheibe (12) mit inneren und äußeren Umfangsoberflächen und Mitteln (14, 15) zum Anordnen der Scheibe für eine Drehung mit der Eingangswelle (12);
ein erstes ringförmiges axial festes Reaktionsglied (21), benachbart zu einer Seite der Rotorscheibe (12); ein zweites ringförmiges axial festes Reaktionsglied (23), das auf der gegenüberliegenden Seite der Rotorscheibe (12) angeordnet ist;
eine Vielzahl erster Verbindungsmittel (24, 25) zum Verbinden des ersten und des zweiten axial festen Reaktionsgliedes in einer festen, axial beabstandeten Beziehung, wobei sich alle Verbindungsmittel aus der Vielzahl von Verbindungsmitteln axial erstrecken und radial nach außen bezüglich der äußeren Umfangsoberfläche der Rotorscheibe (12) angeordnet sind;
ein erstes, ringförmiges, axial bewegliches Re-

aktionsglied (27), das zwischen der gegenüberliegenden Seite der Rotorscheibe (12) und dem zweiten axial festen Reaktionsglied (23) angeordnet ist;
ein zweites, relativ bewegbares, ringförmiges Reaktionsglied (28);
eine Vielzahl zweiter Verbindungsmittel (29, 30) zum Verbinden des ersten und des zweiten bewegbaren Reaktionsgliedes aneinander, und zwar um einen festgelegten axialen Abstand voneinander entfernt, wobei alle Verbindungsmittel der Vielzahl von Verbindungsmitteln sich axial erstrecken und radial außen bezüglich der äußeren Umfangsoberfläche der Rotorscheibe angeordnet sind;
eine ringförmige Scheibe aus Reibmaterial (18), das zwischen jeder sich radial erstreckenden Seite der Rotorscheibe und dem ersten festen und dem ersten beweglichen Reaktionsglied befestigt ist;
Federmittel (35) zwischen dem ersten axial bewegbaren Reaktionsglied (27) und dem zweiten relativ festen Reaktionsglied (23) zum Vorspannen des bewegbaren Reaktionsglieds in einen Reibungseingriff mit der Scheibe;
wobei das zweite feste Reaktionsglied (23) und das zweite bewegliche Reaktionsglied (28) eine ringförmige Druckkammer (38) formen, welche unter Druck gesetzt bewirkt, daß sich die bewegbaren Glieder axial weg von der Rotorscheibe bewegen, um die Federmittel zusammenzudrücken und um das erste ringförmige, axial bewegbare Reaktionsglied aus dem Eingriff mit der Scheibe zu bringen.

2. Federbetätigte Kupplungsvorrichtung nach Anspruch 1, wobei das erste bewegbare Reaktionsglied (27) gleitbar auf den ersten Verbindungsmitteln (24, 25) angebracht ist.

3. Federbetätigte Kupplungsvorrichtung nach Anspruch 2, wobei die ersten Verbindungsmittel (24, 25) ein Abstandshalterohr (25) umfassen, welches zwischen den ersten und zweiten relativ festen Reaktionsgliedern angeordnet ist, sowie Befestigungsmittel (24) zum Befestigen der ersten und zweiten Reaktionsglieder aneinander.

4. Federbetätigte Kupplungsvorrichtung nach Anspruch 3, wobei die Befestigungsmittel (24) durch die rohrförmigen Abstandshaltermittel (25) hindurchgehen.

5. Federbetätigte Kupplungsvorrichtung nach Anspruch 1, wobei die zweiten Verbindungsmittel (29, 30) ein Abstandshalterohr (30) aufweisen, das zwischen den ersten und zweiten bewegbaren Reaktionsgliedern angeordnet ist, sowie Befestigungsmittel (29) zum Befestigen der ersten und zweiten Reaktionsglieder aneinander.

6. Federbetätigte Kupplungsvorrichtung nach Anspruch 5, wobei die Befestigungsmittel (29) durch die rohrförmigen Abstandshaltermittel (30) hindurchgehen.

7. Federbetätigte Kupplungsvorrichtung nach Anspruch 1, wobei jedes Verbindungsmittel der Vielzahl erster (24, 25) und zweiter (29, 30) Verbindungsmittel umfangsmäßig versetzt sind und von einer Seite der Vorrichtung zugänglich sind.

8. Federbetätigte Kupplungsvorrichtung nach Anspruch 1, wobei die Druckkammer (38) radial innerhalb der ersten und zweiten Verbindungsmittel angeordnet ist.

9. Federbetätigte Kupplungsvorrichtung (10) nach Anspruch 1, wobei das zweite feste Reaktionsglied (23) einen ringförmigen Kolben aufweist, wobei das zweite bewegbare Reaktionsglied (28) eine ringförmige Kammer aufweist zur Aufnahme des ringförmigen Kolbens darin und zum Definieren einer ringförmigen Druckkammer (38) zwischen dem ringförmigen Kolben und der ringförmigen Kammer, wobei die ringförmige Druckkammer (38) unter Druck gesetzt eine Bewegung des zweiten bewegbaren Reaktionsglieds (28) relativ zu dem ringförmigen Kolben (23) bewirkt, um die Federmittel (35) zusammenzudrücken und das erste ringförmige Reaktionsglied (27) aus dem Eingriff mit der Scheibe (12) zu bringen.

10. Federbetätigte Kupplungsvorrichtung (10) nach Anspruch 1, wobei die zweiten Verbindungsmittel (29, 30) ein Abstandshalterohr (30) umfassen, das zwischen den ersten und zweiten bewegbaren Reaktionsgliedern angeordnet ist, sowie Befestigungsmittel (29), die durch die rohrförmigen Abstandshaltermittel (30) hindurchgehen, um die ersten und zweiten Reaktionsglieder aneinander zu befestigen; und
wobei das zweite feste Reaktionsglied (23) einen ringförmigen Kolben aufweist, wobei das zweite bewegbare Reaktionsglied (28) eine ringförmige Kammer aufweist zur Aufnahme des ringförmigen Kolbens darin und zum Definieren der ringförmigen Druckkammer (38) zwischen dem ringförmigen Kolben und der ringförmigen Kammer, wobei die ringförmige Druckkammer (38) unter Druck gesetzt eine Bewegung des zweiten bewegbaren Reaktionsglieds (28) relativ zu dem ringförmigen Kolben

(23) bewirkt, um die Federmittel (35) zusammenzudrücken und um das erste ringförmige Reaktionsglied (27) aus dem Eingriff mit der Scheibe (12) zu bringen.

Revendications

1. Dispositif de couplage appliqué par ressort (10) comprenant :

un arbre d'entrée (11) tournant relativement;

un disque rotor s'étendant radialement vers l'extérieur (12) comprenant des surfaces périphériques interne et externe et un moyen (14) (15) pour monter ledit disque tournant avec ledit arbre d'entrée (12);

une première pièce annulaire de réaction fixe axialement (21) adjacente d'un coté audit disque rotor (12);

une seconde pièce de réaction annulaire de réaction fixe axialement (23) placée sur le coté opposé dudit disque rotor (12);

une pluralité d'un premier moyen de connexion (24) (25) pour relier ladite première pièce de réaction et ladite seconde pièce de réaction fixe axialement dans une relation d'espacement fixe, tout de ladite pluralité du moyen de connexion s'étendant axialement et tout est positionné radialement vers l'extérieur de ladite surface périphérique externe dudit disque rotor (12);

une première pièce de réaction annulaire mobile axialement (27) placée entre ledit coté opposé dudit disque rotor (12) et ladite seconde pièce de réaction fixe axialement (23);

une seconde pièce de réaction annulaire mobile respectivement (28);

une pluralité de seconds moyens de liaison (29, 30) pour relier ensemble ladite première pièce et ladite seconde pièce de réaction mobile séparées par une distance axiale fixe, tout de ladite pluralité du moyen de connexion s'étendant axialement et tout étant placé radialement vers l'extérieur de la dite surface périphérique externe dudit disque rotor;

un disque annulaire d'une matière pour friction (18) fixée entre chaque coté s'étendant radialement dudit disque rotor, de ladite première pièce de réaction fixe et de ladite première pièce de réaction mobile;

des moyens à ressort (35) entre ladite première pièce de réaction mobile axialement (27) et ladite seconde pièce de réaction fixe respectivement (23) pour pousser ladite pièce de réaction mobile dans un contact par friction avec ledit disque;

ladite seconde pièce de réaction fixe (23) et la seconde pièce de réaction mobile (28) formant une chambre de pression annulaire (38) qui, lorsqu'elle est mise sous pression, provoque le déplacement de ladite pièce mobile axialement en s'écartant dudit disque rotor en comprimant ledit moyen ressort et, dégage ladite première pièce de réaction annulaire axialement mobile, dudit disque.

2. Dispositif de couplage appliqué par ressort selon la revendication 1 dans lequel ladite première pièce de réaction mobile (27) est montée de manière coulissante sur ledit premier moyen de liaison (24,25).

3. Dispositif de couplage appliqué par ressort selon la revendication 2 dans lequel ledit premier moyen de connexion (24, 25) comprend un tube d'espacement (25) placé entre ladite première pièce de réaction et ladite seconde pièce de réaction fixe respectivement et un moyen de fixation (24) pour fixer ensemble ladite première pièce de réaction et ladite seconde pièce de réaction.

4. Dispositif de couplage appliqué par ressort selon la revendication 3 dans lequel ledit moyen de fixation (24) passe à travers ledit moyen d'espacement (25) tubulaire.

5. Dispositif de couplage appliqué par ressort selon la revendication 1 dans lequel ledit second moyen de liaison (29,30) comprend un tube d'espacement (30) placé entre ladite première pièce de réaction et ladite seconde pièce de réaction mobile et ledit moyen de fixation (29) pour fixer ensemble ladite première pièce de réaction et ladite seconde pièce de réaction.

6. Dispositif de couplage appliqué par ressort selon la revendication 5 dans lequel ledit moyen de fixation (29) passe à travers ledit moyen d'espacement (30) tubulaire.

7. Dispositif de couplage appliqué par ressort selon la revendication 1 dans lequel chacune desdites pluralité dudit premier moyen (24, 25) et dudit second moyen (29, 30) de liaison est décalée sur la circonférence et elle est accessible par un coté dudit dispositif.

8. Dispositif de couplage appliqué par ressort selon la revendication 1 dans laquelle ladite chambre sous pression (38) est placée radialement à l'intérieur dudit premier et dudit second moyen de connexion.

9. Dispositif de couplage appliqué par ressort (10) selon la revendication 1 dans lequel ladite seconde pièce de réaction fixe (23) comprend un piston annulaire, ladite seconde pièce de réaction mobile (28) comprend une chambre annulaire recevant ledit piston annulaire dans celle-ci et définissant ladite chambre de pression annulaire (38) entre ledit piston annulaire et ladite chambre annulaire, ladite chambre de pression annulaire 38 lorsqu'elle est mise sous pression, produit le mouvement de ladite seconde pièce de réaction mobile (28) par rapport audit piston annulaire (23) pour comprimer ledit moyen ressort (35) et elle dégage ladite première pièce de réaction annulaire (27) dudit disque (12).

10. Dispositif de couplage appliqué par ressort (10) selon la revendication 1 dans lequel ledit second moyen de connexion (29,30) comprend un tube d'espacement (30) placé entre ladite première pièce et ladite seconde pièce de réaction mobile et un moyen de fixation (29) passant à travers ledit moyen d'espacement (30) tubulaire pour fixer ensemble ladite première pièce et ladite seconde pièce de réaction; et

dans lequel ladite seconde pièce de réaction fixe (23) comprend un piston annulaire, ladite seconde pièce de réaction mobile (28) comprend une chambre annulaire recevant ledit piston annulaire dans celle-ci et définissant ladite chambre de pression annulaire (38) entre ledit piston annulaire et ladite chambre annulaire, ladite chambre de pression annulaire (38) lorsqu'elle est mise sous pression, produit le mouvement de ladite seconde pièce de réaction mobile (28) par rapport audit piston annulaire (23) pour comprimer ledit moyen ressort (35) et elle dégage ladite première pièce de réaction annulaire (27) dudit disque (12).

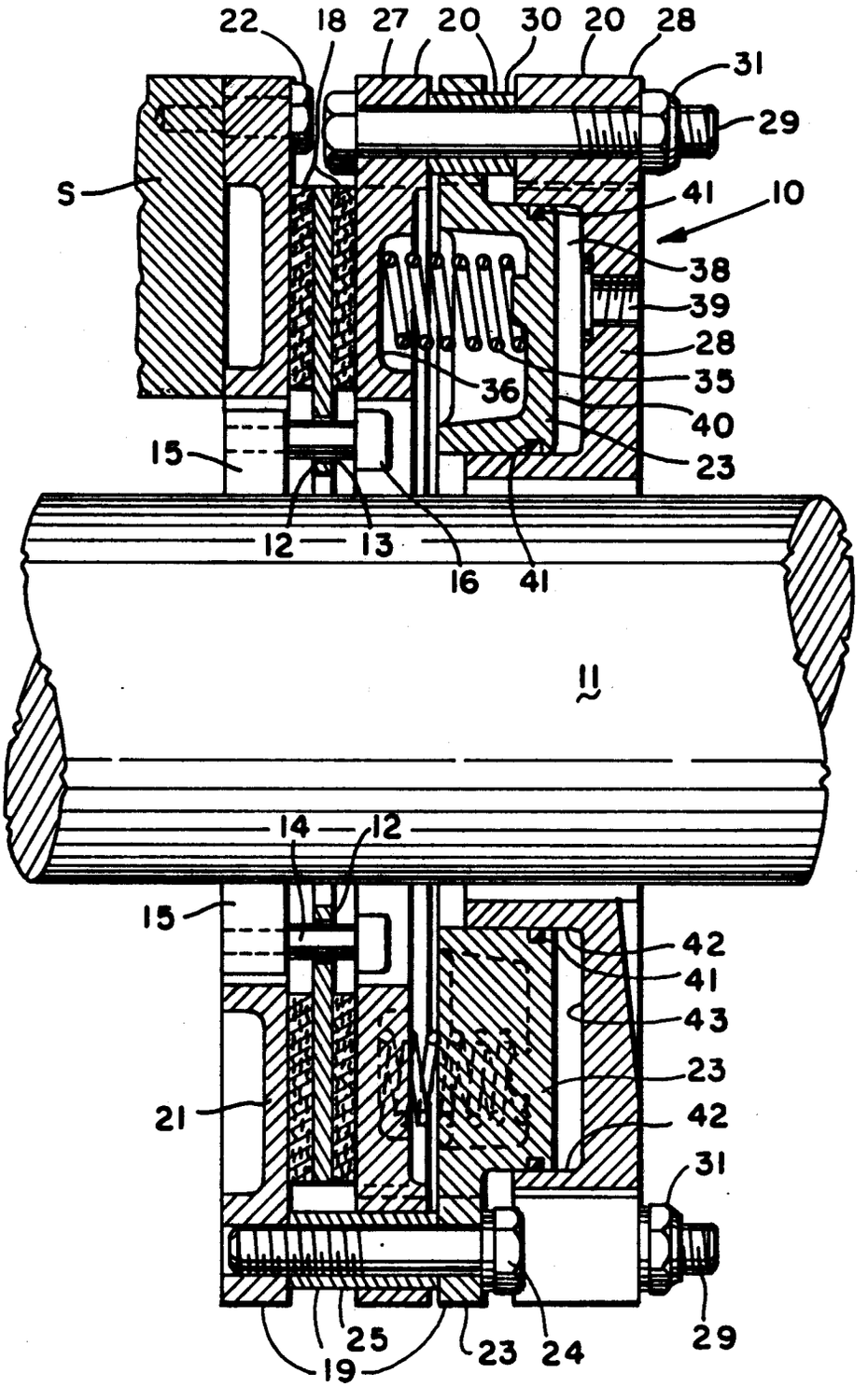
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Fig. 1

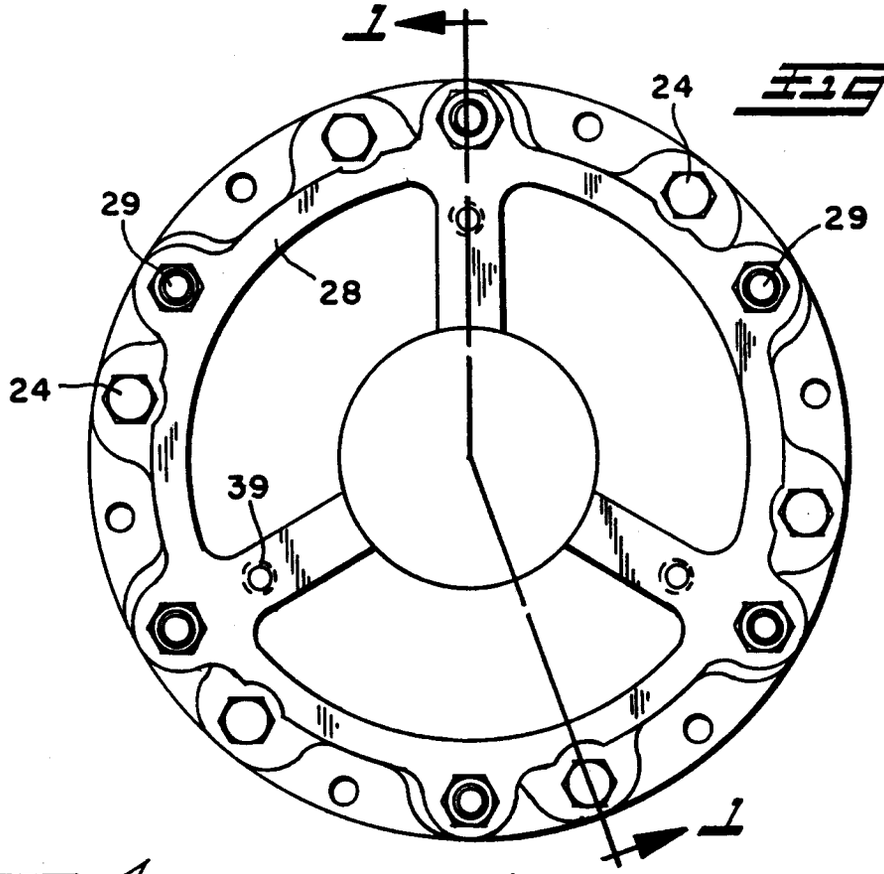


Fig. 2

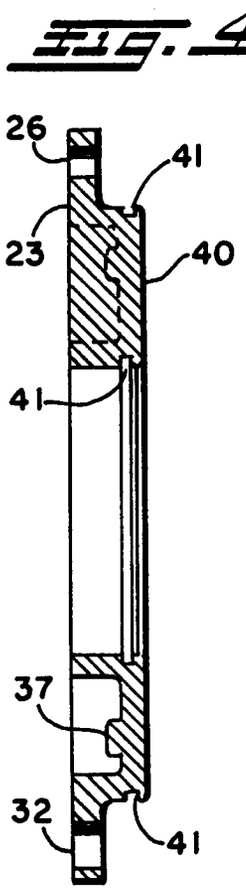


Fig. 4

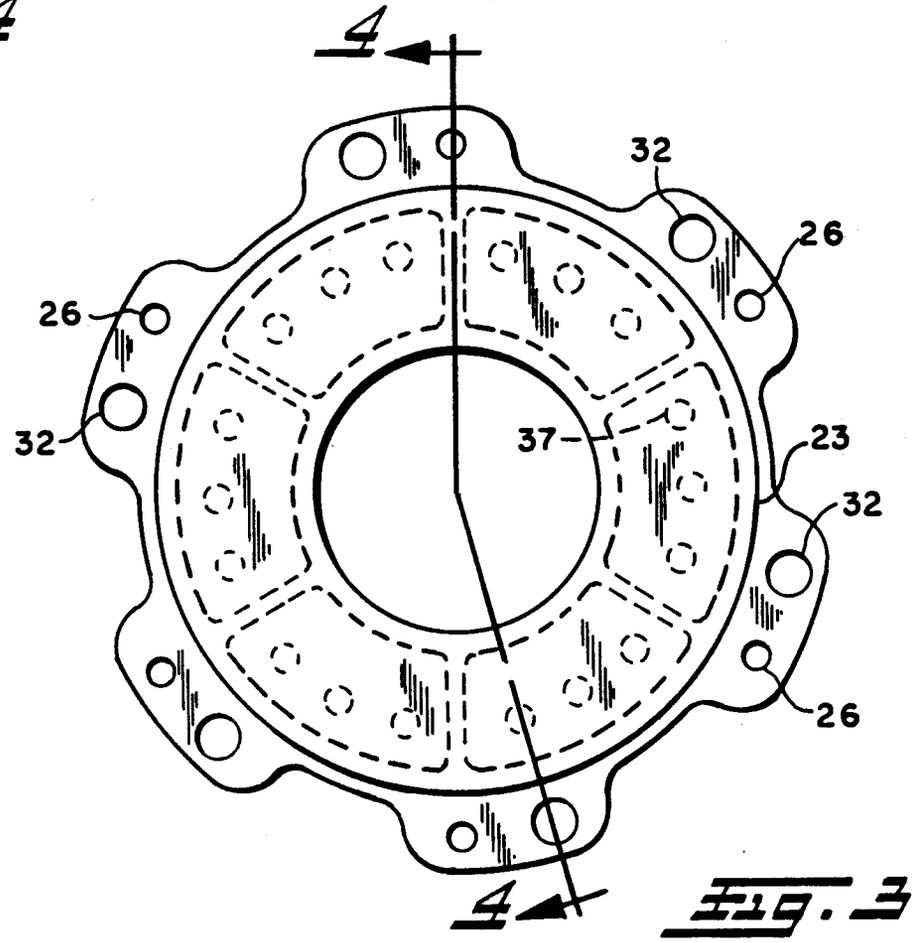
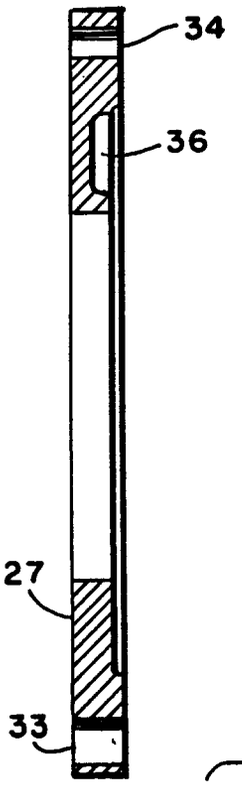


Fig. 3

Fig. 6



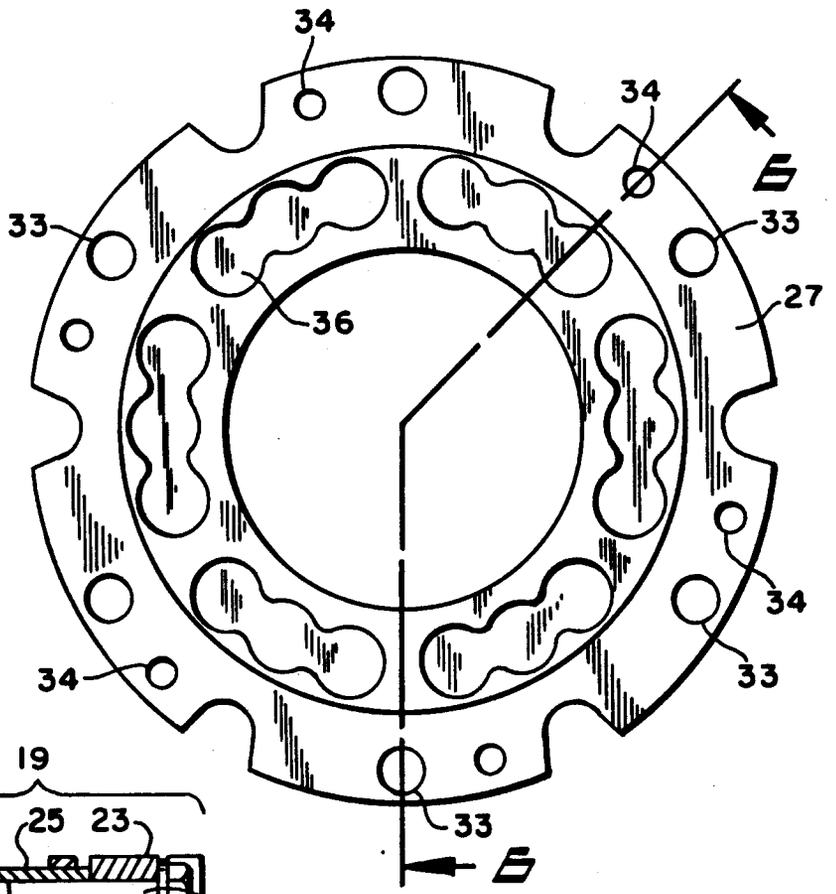


Fig. 5

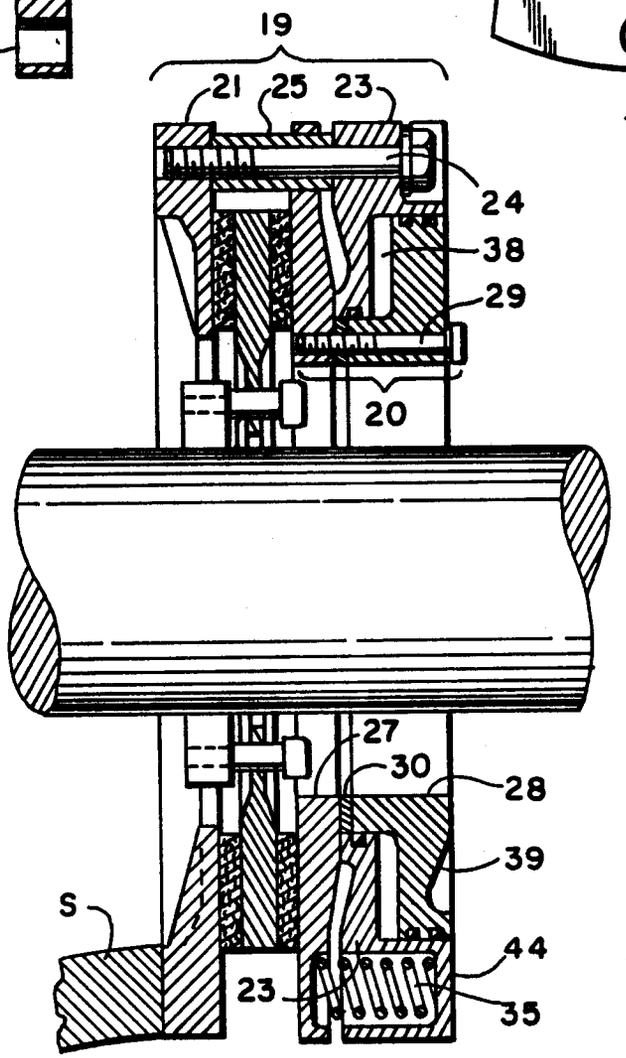


Fig. 7